being measured at a few experimental stations and will be discussed in special contributions.

Sensible temperatures.—The sensation of temperature experienced by the human body and ordinarily attributed to the condition of the atmosphere depends not merely on the temperature of the air, but also on its dryness, on the velocity of the wind, and on the suddenness of atmospheric changes, all combined with the physiological condition of the observer. A satisfactory expression for the relation between atmospheric conditions and nervous sensations has not yet been obtained.

PRECIPITATION.

[In inches and hundredths.]

The *distribution of precipitation* for the current month, as determined by reports from about 2,500 stations, is exhibited on Chart III. The numerical details are given in Tables I, II, and III. The total precipitation for the current month (from 9 to 30 inches) was heavy on the coasts of Washington, Oregon, and northern California; it was quite light over the rest of the United States, but was rather heavy (7.7) at St. Johns, N. F. The larger values at regular stations were: Pysht, 25.3; Tatoosh Island, 19.9; Astoria, 19.1; Fort Canby, 16.0.

Details as to *excessive precipitation* are given in Tables XII and XIII.

The *years of greatest and least precipitation* for December are given in the REVIEW for December, 1890. The precipitation for the current month was the greatest on record only at Astoria, 19.14. It was the least on record at: Lander, T.; Bismarck, 0.03; Miles City, 0.09; Lynchburg, 0.13; Chicago, 0.16; Fort Smith, 0.33; Baltimore, 0.37; Harrisburg, 0.40; Springfield, Mo., 0.79; Northfield, 0.81; Buffalo, 0.84; Sault Ste. Marie, and Knoxville, 0.95; Parkersburg and Narragansett Pier, 1.56.

The *diurnal variation*, as shown by tables of hourly means of the total precipitation, deduced from self-registering gauges kept at the regular stations of the Weather Bureau, is not now tabulated.

The *current departures* from the normal precipitation are given in Table I, which shows that precipitation was in excess in small portions of the South Atlantic and Florida coasts, northwestern Texas, southern Arizona and California, northern California and Washington. It was deficient over the greater part of the country, and especially in the central Gulf, Middle Atlantic and New England States.

The large excesses were: Astoria, 8.1; Fort Canby, 6.1; Tatoosh Island, 5.4; Savannah, 3.6. The large deficits were: Shreveport, 3.9; Little Rock, 3.8; Chattanooga, 3.7; Vicksburg and Memphis, 3.6.

The *average departure* for each district is given in Table I. By dividing each current precipitation by its respective normal the following corresponding percentages are obtained (precipitation is in excess when the percentage of the normal exceeds 100):

Above the normal: South Atlantic, 109; southern Slope (Abilene), 248; north Pacific, 134.

Normal: Northern Plateau, 100.

Below the normal: New England, 61; Middle Atlantic, 35; Florida Peninsula, 96; east Gulf, 54; west Gulf, 33; Ohio Valley and Tennessee, 40; lower Lake, 64; upper Lake, 42; North Dakota, 43; upper Mississippi, 36; Missouri Valley, 40; northern Slope, 22; middle Slope, 59; southern Plateau, 73; middle Plateau, 36; middle Pacific, 95; south Pacific, 69.

The *total accumulated monthly departures* from normal precipitation from January 1 to the end of the current month are given in the second column of the following table; the third column gives the percentage of the current accumulated precipitation relative to its normal value.

Districts.	Accumulated departures.	Accumulated precipitation.	Districts.	Accumulated departures.	Accumulated precipitation.
	Inches.	*Per ct.*		*Inches.*	*Per ct.*
North Dakota	+ 2.90	115	New England	— 5.00	89
Upper Mississippi Valley.	+ 0.40	101	Middle Atlantic	— 7.20	84
Missouri Valley	+ 0.30	101	South Atlantic	—10.70	80
Northern Slope	+ 0.90	106	Florida Peninsula	— 4.00	92
Middle Slope	+ 1.80	109	East Gulf	— 9.00	84
Abilene (southern Slope)	+ 2.30	112	West Gulf	—12.50	71
Southern Plateau	+ 1.10	113	Ohio Valley and Tenn.	— 4.60	90
Middle Plateau	+ 2.40	120	Lower Lake	— 2.10	94
Northern Plateau	+ 1.10	106	Upper Lake	— 2.40	93
North Pacific	+10.10	117	South Pacific	— 1.80	85
Middle Pacific	+ 3.90	113			

SNOWFALL.

The *total monthly snowfall* at each station is given in Table II; its geographical distribution is shown on Chart V. This chart also shows the isotherms of minimum 32° and of minimum 40° for the air within the ordinary thermometer shelter. The former isotherm is an approximate limit to possible snow, while the latter is an approximate southern limit to the regions that report frost in exposed localities.

Snowfalls of from 5 to 20 inches are reported from the Lake Region and New England; 5 to 15 inches in the interior of the South Atlantic States, which was quite phenomenal and did much damage by the breaking of trees and telegraph lines; snowfalls of 10 to 40 inches were reported from the Sierra Nevada, but only from 5 to 15 from the Rocky Mountain region. A maximum snowfall of 64 inches was reported from Cascade Tunnel, Wash.

The *depth of snow on the ground* at the end of the month is given in detail in Table II, and for the winter months is also shown on Chart VI; it is also shown on the weekly charts of the Climate and Crop Service, published by the Weather Bureau during December to March, inclusive.

In general, at the close of the month, there was about 10 inches of snow on the ground in eastern Connecticut and southeastern Massachusetts, whence it diminished to a "trace" in central Pennsylvania and New York and southern Maine, New Hampshire, and Vermont. There was also about 10 inches in the northern peninsula of Michigan and 10 or 15 in central Minnesota and eastern portions of North and South Dakota; from 10 to 20 inches were reported at mountain stations in Colorado and 10 to 40 at stations in the Sierra Nevada.

ICE.

The thickness of ice in the rivers and harbors is shown in detail in the bulletins published every Monday by the Weather Bureau, the more prominent characteristic data for the beginning and end of the month are as follows: Iowa, Sioux City, 8 and 6 inches. Maine, Eastport, 3.5 and 12; Lewiston, 1.5 and 12.0. Minnesota, Moorhead, 15 and 19.5; St. Paul, 10 and 13. Nebraska, Valentine, 14 and 14.0. North Dakota, Bismarck, 8.5 and 21; Williston, 16 and 16.0. South Dakota, Yankton, 12 and 12.0. Wisconsin, Green Bay, 4.5 and 5.0. At the close of the month the Missouri and upper Mississippi were not frozen so far south as on the corresponding date of 1895, but the ice was thicker at some of the more northerly stations. During the middle and close of the month considerable ice existed in the rivers of New England and New York.

Snow and ice in Canada.—On the December Weather Map of the Canadian Service, Mr. R. F. Stupart says:

On Vancouver Island and in British Columbia the rainfall, as in November, has again been very much above the average generally. At Esquimault 10.4 inches fell, which is 3.0 inches above the average. Agassiz recorded 10.0 inches. In the Northwest Territories and Manitoba, where the precipitation was almost entirely if not altogether in the form of snow, the amount was small and in most localities below average. The Lake Superior district shows a marked deficiency in pre-

cipitation, and this deficit is pronounced throughout Ontario, Quebec and the Maritime Provinces, where the total fall for the month was in many places a half or even less than a half of the average amount.

With reference to the quantity of snow and ice on the ground at the end of the month, Mr. Stupart says:

Snow has almost entirely disappeared from low levels in British Columbia, and the general weather is reported as spring-like. In the Northwest Territories, Edmonton reports 16 inches of snow on the ground, Battleford 12 inches, and Prince Albert 5 inches, while Medicine Hat and Swift Current only record a "trace." Ice appears to be from 10 to 18 inches in thickness. In Manitoba, Minnedosa records 12 inches of snow on the ground, and Winnipeg 3 inches, but this amount was materially increased during the heavy snowfall of the 1st of January. In northern Ontario and in Quebec a few inches of snow covered the ground at the end of the month, but this disappeared during the first few days of January owing to the mild weather and heavy rains, and what little ice there is left on the rivers and lakes is very thin.

SLEET.

The following are the dates on which sleet fell in the respective States:

Alabama, 1, 2, 19, 20. Colorado. 13, 24. Connecticut, 11, 15, 16. Delaware, 15, 16, 18. District of Columbia, 15, 18. Georgia, 1, 2, 18. Idaho, 2, 4, 5, 12, 26, 27, 30. Illinois, 6, 17, 25. Indiana, 14, 15, 17, 20, 22. Iowa, 5, 6, 8. Kansas, 7, 20, 21, 26. Kentucky, 15. Louisiana, 1, 2, 20. Maine, 4, 6, 9. Maryland, 15, 18, 23, 30. Massachusetts, 31. Michigan, 4 to 10, 17, 18, 31. Minnesota, 4, 5, 6, 9, 12, 14, 15, 17, 28, 31. Mississippi, 1, 2. Missouri, 8, 13, 17, 18, 19, 23. Montana, 11, 29, 30. Nebraska, 6, 14, 15, 27. Nevada, 5, 12, 25, 27, 29, 30, 31. New Hampshire, 8, 9, 10. New Jersey, 15. New Mexico, 29. New York, 6, 9, 10, 15. North Carolina, 1, 2, 3. North Dakota, 4, 12, 14, 16, 23, 31. Ohio, 4, 14, 15, 16. Oregon, 1, 12. Pennsylvania, 15. South Carolina, 1, 2, 3. South Dakota, 4, 5, 13, 14, 16, 19. Tennessee, 14, 18. Texas, 1. Utah, 13, 29. Vermont, 7, 10. Virginia, 8, 15 to 18. Washington, 1, 2, 4, 7, 9 to 14, 19, 29, 31. West Virginia, 15. Wisconsin, 4, 5, 8, 17.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 14, 15. New Mexico, 29, 30. Oregon, 30, 31. Tennessee, 14. Texas, 31.

WIND.

The *prevailing winds* for December, 1896, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

HIGH WINDS.

Maximum wind velocities of 50 miles or more per hour were reported during this month at regular stations of the Weather Bureau as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		Miles				*Miles*	
Block Island, R. I	15	72	ne.	Helena, Mont	4	50	sw.
Do	16	80	ne.	Kittyhawk, N. C	15	54	n.
Do	17	54	ne.	Do	16	56	n.
Do	23	59	ne.	Nantucket, Mass	15	52	ne.
Buffalo, N. Y	9	56	w.	Do	16	62	ne.
Cheyenne, Wyo	4	56	nw.	Do	17	55	ne.
Eastport, Me	16	56	ne.	New York, N. Y	9	52	sw.
El Paso, Tex	16	58	nw.	Do	16	54	n.
Fort Canby, Wash	3	59	s.	Do	19	51	nw.
Do	6	58	s.	Tatoosh Island, Wash.	3	50	s.
Do	7	58	s.	Do	6	50	s.
Do	9	60	s.	Do	9	54	s.
Do	10	58	s.	Do	13	52	w.
Do	12	72	s.	Do	26	50	ne.
Do	18	52	s.	Woods Hole, Mass	16	54	ne.
Do	29	78	se.	Do	17	50	n.
Hatteras, N. C	2	51	n.	Do	23	52	n.
Do	15	61	nw.	Do	24	50	n.
Do	16	54	nw.				

The *resultant winds*, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table IX. These latter resultants are also shown graphically on Chart IV, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 19 regular stations of the Weather Bureau by its photographic, and at 32 by its thermal effects. At one of these stations records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table XI for each hour of local mean time.

Photographic and thermometric registers give the duration of that intensity of sunshine which suffices to make a record, and, therefore, they generally fail to record for a short time after sunrise and before sunset, because, even in a cloudless sky, the solar rays are then too feeble to affect the self-registers. If, therefore, such records are to be used for determining the amount of cloudiness, they must be supplemented by special observations of the sky near the sun at these times. The duration of clear sky thus specially determined constitutes the so-called twilight correction (more properly a low-sun correction), and when this has been applied, as has been done in preparing Table XI, there results a complete record of the clearness of the sky from sunrise to sunset in the neighborhood of the sun. The twilight correction is not needed when the self-registers are used for ascertaining the duration of a special intensity of sunshine, but is necessary when the duration of cloudiness is alone desired, as is usually the case.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table XI.

COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the *durations* of effective sunshine whence the duration relative to possible sunshine is derived; the observers' personal estimates give the percentage of *area* of clear sky. These numbers have no necessary relation to each other, since stationary banks of clouds may obscure the sun without covering the sky, but when all clouds have a steady motion past the sun and are uniformly scattered over the sky, the percentages of duration and of area agree closely. For the sake of comparison, these percentages have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental records of percentages of durations of sunshine are almost always larger than the observers' personal estimates of percentages of area of clear sky; the average excess for December, 1896, is 6 per cent for photographic and 6 per cent for thermometric records.

The details are shown in the following table, in which the stations are arranged according to the *total possible* duration of sunshine, and not according to the *observed* duration as in previous years.